scale is equal to all that previously known, visible and invisible, as you will see better by this view, having the same thing on the normal as well as the prismatic scale. If it be asked which of these is correct, the answer is "both of them." Both rightly interpreted mean just the same thing, but in the lower one we can more conveniently compare the ground of the researches of others with these. These great gaps I was at first in doubt about, but more recent researches at Alleghany make it probable that they are caused by absorption in our own atmosphere, and not in that of the sun.

We would gladly have stayed longer, in spite of physical discomfort, but the formidable descent and the ensuing desert journey were before us, and certainly the reign of perpetual winter around us grew as hard to bear as the heats of the desert summer had been. On September 10 we sent our instruments and the escort back by the former route, and, ourselves unencumbered, started on the adventurous descent of the eastern precipices by a downward climb, which, if successful, would carry us to the plains in a single day. I at least shall never forget that day, nor the scenery of more than Alpine grandeur which we passed in our descent, after first climbing by frozen lakes in the northern shadow of the great peak, till we crossed the eastern ridges, through a door so narrow that only one could pass it at a time, by clinging with hands and feet as he swung round the shoulder of the rocks—to find that he had passed in a single minute from the view of winter to summer, the prospect of the snowy peaks behind shut out, and instantly exchanged for that below of the glowing valley and the little oasis where the tents of the lower camp were still pitched, the tents themselves invisible, but the oasis looking like a green scarf dropped on the broad floor of the desert. We climbed still downward by scenery unique in my recollection. This view of the ravine on the screen is little more than a memorandum made by one of the party in a few minutes' halt part-way down, as we followed the ice-stream between the tremendous walls of the defile which rose 2000 feet, and between which we still descended, till, toward night, the ice-brook had grown into a mountain torrent, and, looking up the long vista of our day's descent, we saw it terminated by the Peak of Whitney, once more lonely in the fading light of the upper sky.

This site, in some respects unequalled for a physical observatory, is likely, I am glad to say, to be utilised, the President of the United States having, on the proper representation of its value to science, ordered the reservation for such purposes of an area of 100 square miles about and inclusive of Mount Whitney.

There is little more to add about the journey back to civilisation, where we began to gather the results of our observation, and to reduce them—to smelt, so to speak, the metal from the ore we had brought home—a slow but necessary process, which has occupied a large part of two years.

The results stated in the broadest way mean that the sun is blue—but mean a great deal more than that; this blueness in itself being perhaps a curious fact only, but in what it implies, of practical moment.

We deduce in connection with it a new value of the solar heat, so far altering the old estimates that we now find it capable of melting a shell of ice sixty yards thick annually over the whole earth, or, what may seem more intelligible on its practical bearings, of exerting over one horse power for each square yard of the normally exposed surface. We have studied the distribution of this heat in a spectrum whose limits on the normal scale our explorations have carried to an extent of rather more than twice what was previously known, and we have found that the total loss by absorption from atmosphere is nearly double what has been heretofore supposed.

We have found it probable that the human race owes its existence and preservation even more to the heatstoring action of the atmosphere than has been believed.

The direct determination of the effect of water-vapour in this did not come within our scope; but that the importance of the blanketing action of our atmospheric constituents has been in no way overstated, may be inferred when I add that we have found by our experiments that if the planet were allowed to radiate freely into space without any protecting veil, its sunlit surface would probably fall, even in the tropics, below the temperature of freezing mercury.

I will not go on enumerating the results of these investigations, but they all flow from the fact, which they in turn confirm, that this apparently limpid sea above our heads, and about us, is carrying on a wonderfully intricate work on the sunbeam, and on the heat returned from the soil, picking out selected parts in hundreds of places, sorting out incessantly at a task which would keep the sorting demons of Maxwell busy, and as one result, changing the sunbeam on its way down to us in the way we have seen.

I have alluded to the practical utilities of these researches, but practical or not, I hope we may feel that such facts as we have been considering about sunlight and the earth's atmosphere may be stones useful in the future edifice of science, and that if not in our own hands then in those of others, when our day is over, they may find the best justification for the trouble of their search, in the fact that they prove of some use to man.

May I add an expression of my personal gratification in the opportunity with which you have honoured me of bringing these researches before the Royal Institution, and of my thanks for the kindness with which you have associated yourselves for an hour, in retrospect at least, with that climb toward the stars which we have made together, to find, from light in its fullness, what unsuspected agencies are at work to produce for us the light of common day.

ZOOLOGICAL RESEARCH[1]

THE *Vettor Pisani* is soon expected in our port, on her return from a long voyage of no little scientific importance. We think we cannot better hail her arrival than by publishing that portion of Prof. Dohrn's report in which he speaks of the scientific mission fulfilled by this vessel—a mission which, besides meeting with a success far surpassing the highest expectations, has redounded not a little to the benefit of our "Stazione Zoologica."

The time has now arrived, writes the illustrious Professor, for me to speak of an event which took place towards the end of 1881, and which has since borne no inconsiderable fruit. And this, in its turn, takes me back to a conversation which I had in 1878 with the Italian Minister of Marine. I had already proposed that, instead of sending out a young naturalist on board the frigates which sail around the world, a young naval officer should be sent to the "Stazione Zoologica," where, in about four months, he might pick up so much knowledge as would enable him to collect and preserve specimens of marine animals. Owing to a change in the Ministry, my proposition, though accepted in the main, was forgotten; and I only succeeded in getting it put into execution in 1881.

On December 27, 1881, a young naval lieutenant, Signor Gaetano Chierchia, a Neapolitan by birth, introduced himself to me with these words: "I have been sent by the Ministry to learn under your direction at the 'Stazione Zoologica' how to collect and preserve specimens of marine animals. I present myself accordingly, and beg to be allowed to begin work at once." These few words, modest, yet full of energy, made a deep impression on me; for they not only marked the beginning of a new epoch in the active life of the Zoological Station, but also promised a more intimate connection between it and the officers of the Italian navy—an intimacy to which I had looked forward from the very day in which I conceived the idea of the future floating Zoological Station.

With the same modest energy which characterised his first interview with me, Signor Chierchia continued for four months his studies under the special direction of the Curator, Salvatore Lobianco; and all the employes and naturalists of the Zoological Station were astounded at the rapid progress he made in a field so entirely new to him. And when the moment came for establishing my laboratory on board the corvette *Vettor Pisani* (which came most appositely to Naples), and there had been put on board all the fishing apparatus, chemical reagents, alcohol, glass vessels, &c., we accompanied him as a dear friend, and looked forward to results which should mark a distinct advance in the culture of our science. And our expectations, far from being disappointed, were widely surpassed. After only five months there arrived the first consignment—the product of deep-sea work, of dredging and coast-fishery along the shores of Gibraltar, Brazil, and Montevideo. The whole collection was in excellent preservation, carefully labelled and packed, and accompanied by a minute report as to the place and circumstances of each find. And I do not for a moment hesitate to affirm that never has so important a collection of oceanic

[1] From the *Pungolo*, April 23, 1885. Naples, Italy.

animals before reached Europe. Scarce four months had elapsed when there arrived a second consignment, still more extensive than the first, and the result of collections made during a voyage from Montevideo to Cape Horn, around the islands of the Patagonian archipelago (a course which the obliging commander of the corvette, Capt. Palumbo, had followed at my especial desire).

This collection, too, contained most interesting specimens, among which are especially worthy of mention a vast number of tubes filled with the produce of deep-sea fishing (pelagic products). In the same way there have come to hand two other consignments from the Peruvian coast, from the Galapagos Isles, from the coast of Panama; and also some most interesting animals found in small pools and rivers in Peru. Among these, of special importance are two complete series of embryonic forms—first, of a Peruvian ray, and secondly of a toad, which Lieut. Chierchia, at my desire, and to aid my studies in the history of the origin of vertebrate animals, reared with great care, and kept in an excellent state of preservation. In this he was assisted by Dionigi Franzese, who had been trained in the Zoological Station, and had embarked as a sailor on board the *Vettor Pisani*. The *Vettor Pisani* continued its course from Peru across the ocean towards the Philippine Islands and China, and we may look for a new shipment of specimens. In this we have a striking confirmation of my opinion that zoology might receive material aid in its work from naval officers trained for the purpose, rather than from the employment of young naturalists. The example thus presented has been followed by other individuals, and already three more naval officers, Lieuts. Cercone, Orsini, and Colombo, have been trained in the same way at the Zoological Station. It is a matter for regret that the first-mentioned has made but one voyage, a short one towards the West Indies, in which violent gales were encountered. The result of his researches may be seen at the "Station." Lieut. Orsini is in the colony of Assab, at the mouth of the Red Sea, and has despatched thence a valuable and well-preserved collection. Lieut. Colombo is the only one of the three whose studies have been of a more extensive and continuous nature, and for them opportunitp has on several occasions been given him by the Minister of Marine. On board the vessel attached to the Hydrographical Survey, commanded by Capt. Magnaghi (equally well known as a man of science and an officer), he has made excellent collections in the Mediterranean itself, and has now returned once more to the "Stazione" to further prosecute his studies there.

From the very first it has been my intention to invite the naval services of other nations to join us in this line of research, and accordingly, in the autumn of 1882, I proposed to the German Minister of Marine that he should send a naval officer or surgeon to Naples to receive a training such as I have indicated. The head of the Admiralty then, Herr Von Stosch, accepted my proposal, and sent a naval surgeon, Dr. Sander, for four months to Naples. In the autumn of the following year Dr. Sander embarked on board the frigate *Prinz Adalbert* for Eastern Asia. We still await its arrival, and hope for valuable results from the expedition.

A preliminary conversation which I had last summer at St. Petersburg with the head of the staff of the Russian Marine Admiral Tchichatchoff, leaves room for hope that Russia too will consent to join us in the matter, and that so in the course of a few years we may look for a still further and wider development of this connection between the "Stazione Zoologica" and the various marine war services of the world. From such a connection great advantages would accrue, not only to science in general, but also to the naturalists of those several countries, which in their turn would be the richer for the collections made by their respective navies.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—There will be an examination in certain branches of natural science for minor scholarships at Downing College, on Tuesday, June 2 next, and following days. Persons who have not entered at any college in the University are eligible to the minor scholarships, which will be of the value of from 40*l.* to 70*l.* per annum, and tenable until their holders are of standing to compete for a Foundation Scholarship. Further information will be given by Dr. Perkins or the Rev. J. C. Saunders, tutors of the College.

SCIENTIFIC SERIALS

Annalen der Physik und Chimie, No. 3, March, 1885.—Prof. R. W. Bunsen, on capillary absorption of gas. Shows a direct dependence between the capillary pressures and the volumes of gas absorbed. This discovery, doubtless, has important relations in physiological processes. Prof. G. Quincke, electric researches (No. 10), on the measurement of magnetic forces by hydrostatic pressure. The author adopts the formula

$$p = \mathfrak{K}_1 H_1^2/8\pi,$$

where H_1 is the intensity of the magnetic field, and $\mathfrak{K}_1$ a "diamagnetisation constant" analogous to the dielectric constant in the analogous formula for the pressure in the electric field. Observations have been made on many magnetic liquids to ascertain the numerical values of this constant.—O. Lummer, on the theory and form of some newly-observed interference curves. These relate to certain phenomena of thick plates.—C. Christian sen, researches on the optical properties of finely-divided bodies.—W. Möller, on Wild's photometer.—E. and L. Natanson, on the dissociation of the vapour of hyponitrous acid.—M. Thiesen, researches on the equation of state; a discussion of the laws of gaseous pressure.—Prof. L. Pfaundler, on the action of strongly-compressed carbonic acid on glass under the influence of light. W. Voigt, reply to Prof. Wüllner's remarks respecting Jamin's observations on metallic reflection.

Journal of the Russian Chemical and Physical Society, vol. xvi. fasc. 9.—On the oxidation of acetones (second memoir), by G. Wagner. The behaviour of ketones to chromic acid mixture are described, and the general laws of their oxidation are deduced.—On the action of the iodides of allyl and zinc on epichloridrine, by M. Lopatkin.—On isopropyl allyl dimethyl carbinol, by M. Kononovitch.—On the relation between diamagnetism and the temperature of fusion of bodies, by P. Bachmetieff. The absolute heat of fusion being represented by the equation $W = (t + 273)\,cs + bs$, where c is the specific heat, b the latent heat of fusion, and s the specific weight of the body; then, the series $(t + 273)\,s$ being taken according to the figures of Regnault and M. Carnelley—it appears to be in reverse order to Faraday's diamagnetic series, the bodies appearing in the following series which culminates with Bi and Sb:—K, Na, P, Br, S, Mg, Ca, I, Al, In, Sn, Bi, Sb, Zn, Cd, Pb, Ag, Cu, Pd, An, Ur, W, Pt, Ir, Os.—On the atmospheres of planets, the temperature of the sun in cosmic space, and the earth's atmosphere, by E. Rogovsky.—On some new demonstrations of the conditions for a minimum of deviation of a prism, by N. Poltschikoff.—A note in answer to M. Stankevitch, by the same.—Studies in cosmical physics: III. the heating of meteorites when falling on to the earth, by Th. Schwedoff.—Answering to an objection made at the British Association of 1882 by Sir William Thomson to his cosmic theory of hail, the author discusses the heat which a meteoric stone may receive when piercing our atmosphere. He shows by several examples, by our experience of meteorites, and by M. Daubrée's testimony, that they never have been brought to fusion. The meteorite must be compared to a fire syringe (*Briquet pneumatique*), which condensates the air and raises its temperature, remaining nearly cold itself when its conducting power is feeble. The *vis viva* of the meteorite is spent in piercing the layers of air—that is, in bringing them into motion (like a bullet which would spend its force in piercing 1000 sheets of paper before reaching the target), and to admit that its *vis viva* be transformed into heat, would be to forget the force spent in piercing the air.—Index to the sixteenth volume.

Bulletin de la Société des Naturalistes de Moscou, 1884, No. 2.—Materials for the flora of Central Asia, by Prof. N. Sorokine. After having twice visited several parts of Russian Turkistan and the delta of the Amu-daria, M. Sorokine returned with a rich collection of phenogams, which proved this part of the Central Asian flora to be very rich, original, and interesting. The department of Gasteromycetes alone offered the greatest interest, on account of its containing forms peculiar to Algeria, Egypt, Cuba, and so on. There are even several indices which would seem to indicate that the Aral-Caspian region has been a centre of dispersion of several forms, whose sporæ were transported by winds across the Red Sea to Africa, and thence to Spain and France. The whole work of the author could not be published at once, on account of its numerous plates. The description of the Chytridiaceæ has appeared in the *Archives botaniques du Nord de la France*, the remainder will appear in the Moscow *Bulletin*, which contains now the descriptions, with five plates,